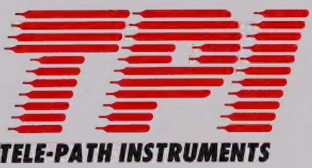
ISDN TEST UNIT
MODEL 527
OPERATING MANUAL

Issue 4A / Firmware 1.06



A Division of TTC

A Dynatech Company

ISDN TEST UNIT
MODEL 527
OPERATING MANUAL

Issue 4A / Firmware 1.06

TELE-PATH INSTRUMENTS
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ISO 9001 Quality System

TPI TELE-PATH INSTRUMENTS
A Division of TTC
A Dynatech Company

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SECTION I

INTRODUCTION

1.1 GENERAL INFORMATION

The Tele-Path Instruments Model 527 ISDN Test Unit is a compact, battery operated device used to conduct testing of ISDN circuits at the customer premise, the input and output of the ISDN repeater housing, or at the main distribution frame. The Model 527 is designed both for rugged durability and ease of use, with LCD and audio response to setup and testing.

The Model 527 will function as a NT1/TE (Network Termination/Terminal Equipment). It is connected to the DSL (Digital Subscriber Loop) at the U interface or, if optioned, at the S/T or POTS interface. It is compatible with the 2B1Q DSL interface.

The Model 527 has an optional S/T interface and/or POTS interface capability. In the S/T mode, the Model 527 will function as a TE (ISDN ready Terminal Equipment), i.e., an ISDN telephone. There are two POTS options. With the POTS1 option, the Model 527 becomes an analog telephone able to place or receive calls, the capability to add line loss on the U interface, and pulse dial capability. With the POTS2 option, the Model 527 becomes an analog telephone able to place or receive calls and supports caller ID, pulse dialing, 40 kHz measurements, and Sense-IT™ (attempting to place a call in POTS mode on an active data line, i.e. ISDN or DDS, will display "Data on line").

The Model 527 ISDN Test Unit allows you to establish a loopback on either B channel. In NT1/TE mode, it will respond to a B1, B2, or full bandwidth (2B+D) loopback command from the Central Office.

ISDN tests made by the Model 527 include:

- FEBE (Far End Block Errors) and NEBE (Near End Block Errors) in ISDN U interface mode
- FE (Frame Errors) and BPV (Bipolar Violations) in ISDN S/T interface mode
- U interface line polarity
- Bearer service selections:
  - Circuit-switched voice and 3.1 kHz audio
  - 56 and 64 kb/s circuit-switched data
  - D packet
- Intelligent Testing (IT™) features:
  - Guess SPID
  - Call Yourself, Loop, and BERT macro
- Bit Error Rate (BER) testing
- Cause message decode
- Insert loss on U interface, with POTS1 option
- Pre-Qualification of loop:
  - Generate 40 kHz tone
  - Measure 40 kHz tone, with POTS2 option
- Establish B1/B2 loopback from unit
- Responds to B1, B2, and 2B+D loopback commands from the C.O.
- Supports BRIV (Basic Rate Interface Verification)

1.1.1 BASIC RATE (BRI) ISDN

INTRODUCTION

ISDN today is a Digital Network which promises a wide range of enhanced services, including Voice, Data, and Image. While ISDN customers may subscribe to either the Primary Rate Interface (PRI) service, or the Basic Rate Interface (BRI) service, BRI has the most immediate application since it is designed to connect individual Terminal Equipment to the Integrated Services Digital Network (ISDN). Centrex services can be configured to provide voice and data service over the same 2-wire single subscriber loop. Telecommuting can be economically supported with the 2B+D format in the home. Business-to-business data communications applications can use 64 Kbps speeds, or even 128 Kbps using two B-Channels.

ISDN BASIC RATE INTERFACE

ISDN divides a standard 2-wire non-loaded telephone line into three digital channels capable of simultaneous voice, data, and low speed video transmission. The three channels are comprised of two Bearer (B) channels, which carry voice, circuit-switched, or packet-switched data up to 64 kb/s, and a 16 kb/s data (D) channel for packet-switched data and signaling information. When combined, the two B channels and one D channel make up the basic rate (2B+D) interface. A maintenance channel and framing information are added, and the result is a transmission rate of 160 kb/s at the U interface. See Figure 1 below:

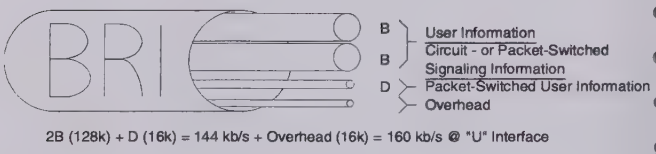


Figure 1. ISDN Basic Rate Interface

A typical configuration for ISDN Basic Rate Interface is shown in Figure 2 below:

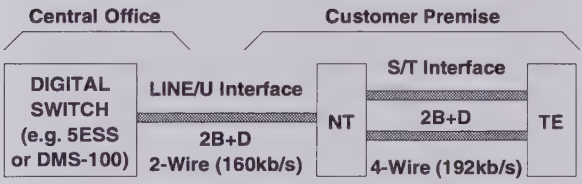


Figure 2. ISDN Basic Rate Interface

LINE/U Interface

The U interface refers to the physical interface on the Network side of an NT1. It is a 2-wire interface that uses an echo canceling technique to transmit and receive information over the same pair of wires. A total data rate of 160 kb/s is used with a 144 kb/s payload.

(NT) Network Termination

Network Termination (NT1) is the Customer Premises termination equipment that converts the 2-wire U interface signal to a 4-wire S/T interface signal. The NT1 also provides some simplified looping capabilities for testing of the facilities.

The term NT2 refers to a device that terminates a PRI ISDN 4-wire interface circuit.

S/T Interface

The S/T interface is the standard ISDN interface used by ISDN Terminals and is the physical interface on the Terminal side of an NT1. It is a 4-wire transmission interface, with one pair used to transmit and one pair used to receive, at a total rate of 192 kb/s with a payload of 144 kb/s.

(TE) Terminal Equipment

Terminal Equipment is a customer ISDN terminal that operates when connected to an ISDN basic rate Interface, either a U or an S/T. Examples are digital telephones, data terminals, integrated work stations, and video conferencing equipment.

Other kinds of customer terminals which operate from a non-ISDN interface (RS-232), would need a Terminal Adapter (TA) to convert from the non-ISDN interface to the S/T ISDN interface.

2B1Q Line Code

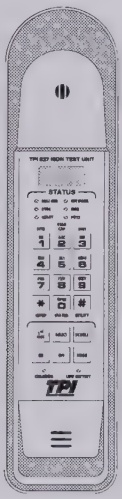
The ANSI U interface specification incorporates a 2B1Q line code, which is the electrical representation of digital signaling, and represents the pattern of pulses carried across the wire that forms the "1's" and "0's" transmitted. 2B1Q adds adaptive digital signal processing to this pattern of pulses, which can smooth out interference on a line to create the capability of using ordinary non-loaded twisted pair for distances of up to 18,000 feet using 26 ga. cable (- 42dB).

The major switch vendors initially used their own proprietary line codes, e.g., AT&T AMI (Alternate Mark Inversion) and NTI AMI, but are now bringing 2B1Q to their products.

The 2B1Q (two binary, one quaternary) line coding is a four level, or quaternary code. Each level is determined from a single combination of two bits. Thus, 160 kb/s (binary) equates to a baud rate of 80 kHz and thus a Nyquist frequency of 40 kHz. The lower frequency is desirable for extending the distance over which transmission is possible.

1.2 PHYSICAL DESCRIPTION

The TPI Model 527 ISDN Test Unit, illustrated below, consists of circuit boards, a 2 x 8 character LCD, and a battery pack, housed in a rugged plastic case. It weighs 1.7 pounds and has external dimensions of 12" high, 2 ¾" wide, and 2 ¾" deep.



The internal battery pack is a custom 9.6 volt Super NiCAD rechargeable flat pack that can be externally charged via the TPI 527-1 Battery Charger/AC Adapter. A fully charged battery will typically last for eight hours of 2B1Q interface operation. When the **LOW BATTERY** LED illuminates, there are approximately 10 minutes of operating time left before complete shutdown. At that time, the internal battery needs to be recharged.

A belt-hook is attached to the top of the unit for convenience to allow attachment of the test set to a line-up rack or belt. The hook may be reversed, if desired by reversing the plate that the hook is attached to, to allow the hook to open from the opposite side.

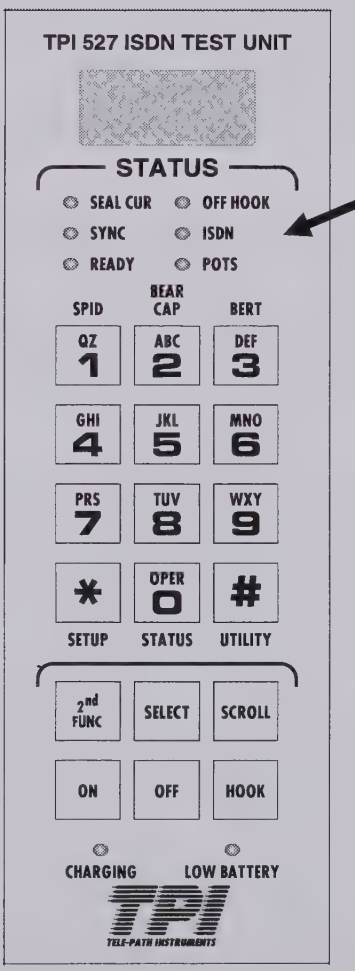
The bottom side of the unit contains a Test Summary Label that outlines unit operation.

1.2.1 EXTERNAL CONNECTIONS

Connection to the DSL U interface is made on the lower end of the set using a test cord with a modular 8-pin connector. Setup should be performed before the test set is connected to the line.

The left side of the case houses a connector for the TPI 527-1 Battery Charger/AC Adapter. Next to the AC Adapter connector is an 8-pin mini DIN connector. This connector provides a remote software upgrade capability. A special programming interface module, part no. TPI 527-PIM, is required to connect the unit to a local PC with special software. Download procedures are documented separately.

1.2.2 CONTROLS AND INDICATORS



STATUS LED's

The **SEAL CUR** LED has two functions. If operating in "U:NT1TE" mode, it will light green when at least 5 mA of sealing current is detected in positive polarity or red in negative polarity. In "S/T:TE" mode, it acts as an indicator of Power Source 2, lighting green if PS 2 has at least 30 volts.

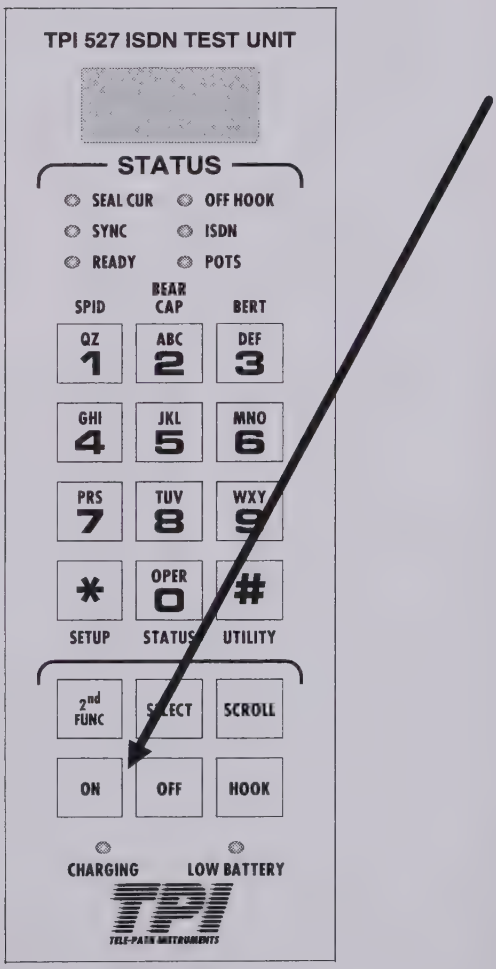
The **SYNC** LED will light green when the test set has been able to gain synchronization with the received BRI carrier signal.

The **READY** LED will light green when the layer 2 initialization process has been completed and indicates a call may be initiated from the test set.

The **OFF HOOK** LED will light green when the **HOOK** key has been pressed placing the Model 527 in an off hook condition.

The **ISDN** LED will light green when the the Model 527 is operating in the ISDN mode.

The **POTS** LED will light green when the the Model 527 is operating in POTS mode.


TPI 527 ISDN TEST UNIT
STATUS
SEAL CUR
OFF HOOK
SYNC
ISDN
READY
POTS
SPID
BEAR CAP
BERT
QZ 1
ABC 2
DEF 3
GHI 4
JKL 5
MNO 6
PRS 7
TUV 8
WXY 9
*
OPER 0
#
SETUP
STATUS
UTILITY
2nd FUNC
SELECT
SCROLL
ON
OFF
HOOK
CHARGING
LOW BATTERY
TPI
TELE-PATH INSTRUMENTS

POWER

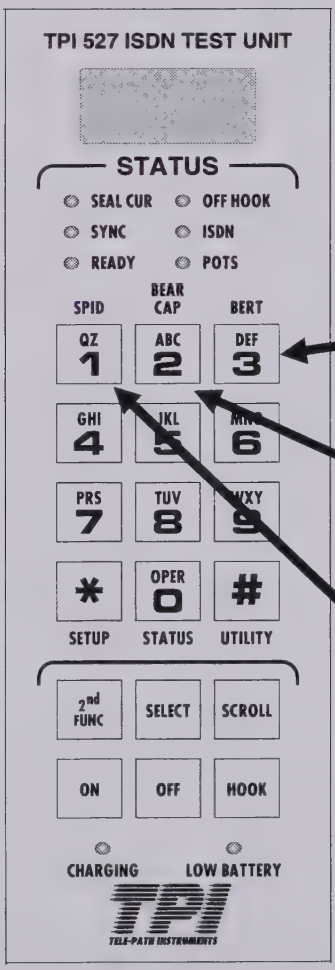
The **ON** and **OFF** buttons are used to control the ISDN Test Unit's power.

The Model 527 has an *Auto Power-Down* feature which will turn the unit off if there is no keypad activity or sync for 10 minutes.

The **CHARGING** LED will light green when the AC Adapter has been plugged into an AC 110V outlet.

The **LOW BATTERY** LED will light red when there is approximately 10 minutes of operating time left before complete shutdown.

CAUTION: *The 10 minute low battery warning is only approximate, and will depend on several factors. To ensure proper operation throughout the testing procedures, we recommend that you recharge the battery as soon as the* ***LOW BATTERY*** *warning LED lights.*


TPI 527 ISDN TEST UNIT
STATUS
SEAL CUR
OFF HOOK
SYNC
ISDN
READY
POTS
SPID
BEAR CAP
BERT
QZ 1
ABC 2
DEF 3
GHI 4
JKL 5
6
PRS 7
TUV 8
9
*
OPER 0
#
SETUP
STATUS
UTILITY
2nd FUNC
SELECT
SCROLL
ON
OFF
HOOK
CHARGING
LOW BATTERY
TPI
TELE-PATH INSTRUMENTS

FUNCTION KEYS

When the Model 527 is in the On Hook mode, all of the function keys associated with the dial pad (SPID, BEAR CAP, BERT, SETUP, STATUS, UTILITY) are active. When the test set is in the Off Hook mode, the **2nd FUNC.** key must be pressed prior to selecting one of the function keys.

The dedicated function keys **2nd FUNC.**, **SELECT**, **SCROLL**, **HOOK**, and power **OFF** are always active when the unit is on. Only the power ON key is active with the power off.

BERT Function Key

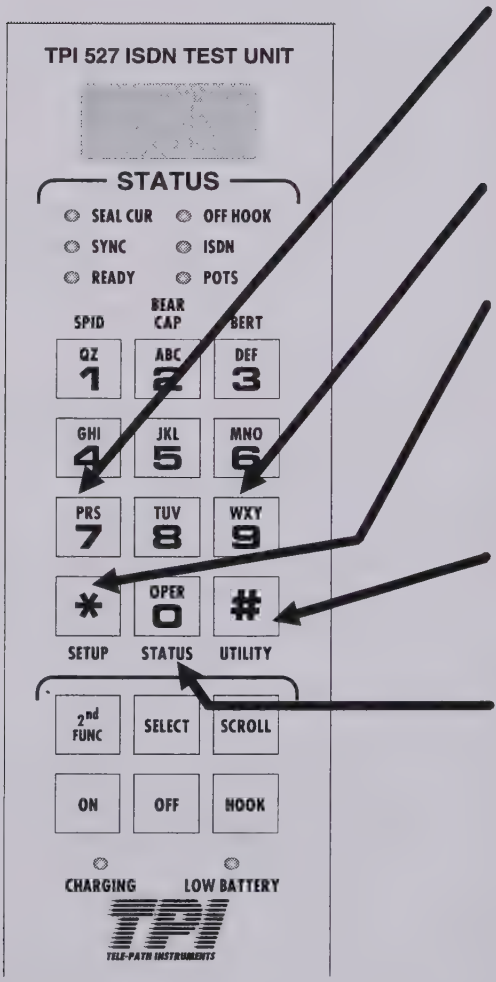
The **BERT** function key is used to perform Bit Error Rate Testing on either of the B channels.

BEAR CAP Function Key

The **BEAR CAP** function key is used to select the bearer capability. The bearer capability is the type of call: voice, data, 3.1k audio, or D packet.

SPID Function key

The **SPID** function key is used to program the Service Profile Identifier for the line under test. Enter the SPID using the keypad. The last key stroke must be **SCROLL** to store the new SPID.


TPI 527 ISDN TEST UNIT
STATUS
SEAL CUR
OFF HOOK
SYNC
ISDN
READY
POTS
SPID
BEAR CAP
BERT
QZ 1
ABC 2
DEF 3
GHI 4
JKL 5
MNO 6
PRS 7
TUV 8
WXY 9
*
OPER 0
#
SETUP
STATUS
UTILITY
2nd FUNC
SELECT
SCROLL
ON
OFF
HOOK
CHARGING
LOW BATTERY
TPI
TELE-PATH INSTRUMENTS

STORE Function key

The **STORE** function key (key 7) is used to store frequently dialed numbers.

SPEED DIAL Function key

The **SPEED DIAL** function key (key 9) is used to dial stored numbers.

SETUP Function Key

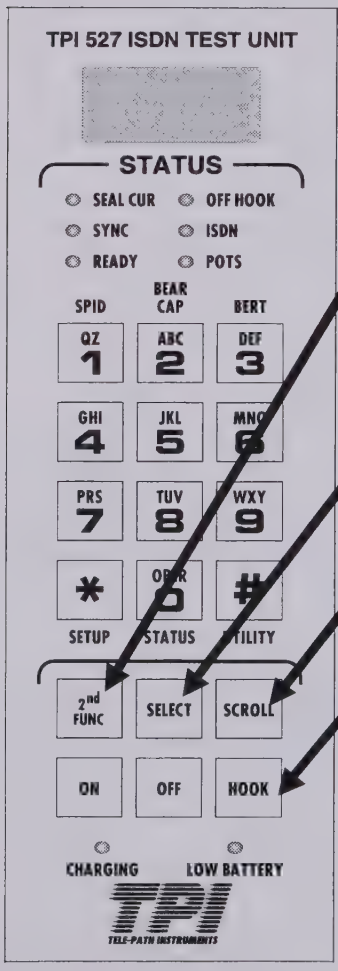
The **SETUP** function key is used to review or change the current setup.

UTILITY Function Key

The **UTILITY** function key is used to configure the various test set utilities. Testing modes (e.g., ISDN/POTS, generate/measure 40 kHz tone) and test set configuration items (e.g., backlight, handset/speakerphone, B1/B2 loopbacks) can be selected.

STATUS Function key

The **STATUS** function key is used to display diagnostic cause messages, and view test results.


TPI 527 ISDN TEST UNIT
STATUS
SEAL CUR
OFF HOOK
SYNC
ISDN
READY
POTS
SPID
BEAR CAP
BERT
QZ 1
ABC 2
DEF 3
GHI 4
JKL 5
MNO 6
PRS 7
TUV 8
WXY 9
*
0 OPER
#
SETUP
STATUS
UTILITY
2nd FUNC
SELECT
SCROLL
ON
OFF
HOOK
CHARGING
LOW BATTERY
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TELE-PATH INSTRUMENTS

2nd FUNC key

The **2nd FUNC** key is used to give other keys a second function.

If Off Hook, **2nd FUNC** must be pressed prior to selecting a key. For example, if **2nd FUNC** is not pressed, selecting **2** will enter that digit to be dialed, but if **2nd FUNC** is selected then **2** is pressed, the bearer capability may be changed.

SELECT key

The **SELECT** key is used to step through available selections on a menu.

SCROLL key

The **SCROLL** key is used to scroll through menus and to accept or exit a menu.

HOOK key

The **HOOK** key is used to move between the On Hook and Off Hook modes when placing or receiving calls. The **OFF HOOK** LED will light green when in the Off Hook mode. For more information on placing calls, see Section 2.3.

1.3 MENUS

1.3.1 SETUP

When the unit is first powered up, it will conduct the Power On Self Test. Upon successful completion of the Power On Self Test, the present setup of the unit will be displayed:

```
U VOICE
NAT'L
```

NOTE: *The Setup menu may also be accessed by pressing the* **SETUP** *function key.*

This menu indicates ISDN service, access at the U interface, Voice bearer capability, and National call control. Other menus follow to review/change these and other items. Pressing **SELECT** accepts the setup and moves to the Hook screen (See Section 1.3.9).

NOTE: *A "Service" selection - ISDN or POTS - is available under the* **UTILITY** *menu.*

Press **SCROLL** to display the MODE menu (if the S/T option is installed, otherwise the call control menu will be displayed):

```
MODE:
U:NT1 TE
```

Pressing **SELECT** will scroll through available selections: "U:NT1TE" (U interface, NT1TE mode) or "S/T: TE" (S/T interface, TE mode). Press the **SCROLL** key to enter the desired setting.

The following menu will result:

Pressing **SELECT** will scroll through the selections: "NAT'L", "DMS-F", "5ESS-PP", or "5ESS-MP".

"NAT'L" (National ISDN) is the Bellcore standard call control. "DMS-F" is the custom call control used on Nortel switches. "5ESS-PP" and "5ESS-MP" are the custom call controls used on AT&T 5ESS switches.

Press the **SCROLL** key to enter the desired setting and the following menu will be displayed:

This menu selects the type of test (bearer capability). Pressing **SELECT** will scroll through available selections: "VOICE", DATA 56k", "DATA 64k", "3.1KHZ" or "D-CH PKT". Press the **SCROLL** key to enter the desired setting.

If "5ESS-PP" was selected as the call control, the "No SPID in 5E-PP" message will be displayed. Press the **SCROLL** key to exit the Setup menu and move to the Hook screen.

If "NAT'L", "DMS-F", or "5ESS-MP" call control was selected, the following menu will be displayed:

```
GUESSPID
NO,1 =YES
```

A Service Profile Identifier (SPID) is used by Terminal Equipment (TE) to request initialization from the switch on a multipoint circuit.

If you know what the SPID is for the circuit being tested, you can move to the SPID entry screen by pressing the **SCROLL** key.

If you are not sure what the SPID is, the test set can often "guess" the SPID based on the 10-digit phone number (area code + directory number) assigned to the circuit. To have the test set "guess" the SPID, press the **1** key. The following screen is displayed:

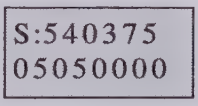
```
Enter 10
Digit DN
```

Enter the 10-digit phone number using the keypad, then press the **SCROLL** key.

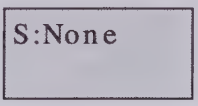
NOTE: *If not connected to a line, pressing **SCROLL** will display a "NO LAYER 1" message.*

The test set momentarily displays "GUESSING SPID", then begins to display possible SPIDs. If the test set is unable to "guess" the SPID, "SPID NOT FOUND" will be displayed.

Once a valid SPID has been found, is it displayed as follows:



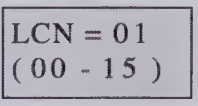
If SPID Guess is not selected, the following menu will be displayed:



This menu allows the SPID to be verified or changed (see Section 1.3.2). Enter the SPID using the keypad. Pressing **2nd FUNC**, **SCROLL** will backspace one character.

Once the SPID has been "guessed" or entered with the keypad, press the **SCROLL** key to enter the SPID and exit the Setup menu. The Hook screen is displayed.

If "D-CH PKT" is selected as the TEST (bearer capability), the following menu will be displayed:



This menu selects the Logical Channel Number. The Logical Channel Number is used to designate the virtual channel to be used by a packet data call at the network interface. The default is 1.

Enter the number using the keypad, followed by the **SCROLL** key to enter the number. The TEI menu will then be displayed:

```
TEI:
AUTO:127
```

Pressing **SELECT** will scroll through available selections: "AUTO" or "FIXED". If "FIXED" is selected, enter the TEI using the keypad. Press the **SCROLL** key to enter the desired setting.

If "5ESS-PP" was selected as the call control, the "No SPID in 5E-PP" message will be displayed. Press the **SCROLL** key to exit the Setup menu and move to the Hook screen.

If "NAT'L", "DMS-F", or "5ESS-MP" call control was selected, the following menu will be displayed:

```
GUESSPID
NO,1 =YES
```

If you know what the SPID is for the circuit being tested, you can move to the SPID entry screen by pressing the **SCROLL** key.

If you are not sure what the SPID is, press the **1** key. The following screen is displayed:

```
Enter 10
Digit DN
```

Enter the 10-digit phone number using the keypad, then press the **SCROLL** key.

NOTE: *If not connected to a line, pressing **SCROLL** will display a "NO LAYER 1" message.*

The test set momentarily displays "GUESSING SPID", then begins to display possible SPIDs. If the test set is unable to "guess" the SPID, "SPID NOT FOUND" will be displayed. Once a valid SPID has been found, is it displayed as follows:

```
S:540375
05050000
```

If SPID Guess is not selected, the following menu will be displayed:

```
S:None
```

Enter the SPID using the keypad. Pressing **2nd FUNC**, **SCROLL** will backspace one character. Once the SPID has been "guessed" or entered with the keypad, press the **SCROLL** key to enter the SPID and exit the Setup menu. The Hook screen is displayed.

```
IDLE      V
      ANY>
```

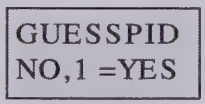
For information on the Hook screen, refer to Section 1.3.9.

1.3.2 SPID

A Service Profile Identifier (SPID) is used by Terminal Equipment (TE) to request initialization from the switch on a multipoint circuit.

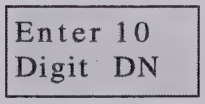
If "5ESS-PP" was selected as the call control, the "No SPID in 5E-PP" message will be displayed when **SPID** (key **1**) is pressed. Press the **SCROLL** key to exit the SPID menu and move to the Hook screen.

If "NAT'L", "DMS-F", or "5ESS-MP" call control was selected, the following menu will be displayed when **SPID** (key **1**) is pressed:



If you know what the SPID is for the circuit being tested, you can move to the SPID entry screen by pressing the **SCROLL** key.

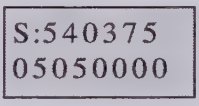
If you are not sure what the SPID is, the test set can often "guess" the SPID based on the 10-digit phone number (area code + directory number) assigned to the circuit. To have the test set "guess" the SPID, press the **1** key. The following screen is displayed:



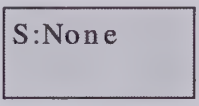
Enter the 10-digit phone number using the keypad, then press the **SCROLL** key.

NOTE: *If not connected to a line, pressing* ***SCROLL*** *will display a "NO LAYER 1" message.*

The test set momentarily displays "GUESSING SPID", then begins to display possible SPIDs. If the test set is unable to "guess" the SPID, "SPID NOT FOUND" will be displayed. Once a valid SPID has been found, is it displayed as follows:



If SPID Guess is not selected, the following menu will be displayed:



This menu allows the SPID to be verified or changed.

Historically, for 5ESS, the SPID is formed by adding "01" to the beginning of the 7-digit number and followed with a "0". (As an example, "0137505000" is the SPID for Telephone Number 540-375-0500)

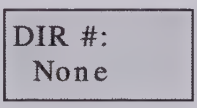
For NTI Functional, the SPID is the 10-digit primary directory number plus an optional two digit SPID suffix. (For example, "5403750500 00".)

The Terminal ID (TID) is required for National translations and is entered as part of the SPID. The TID is a two-digit number from 00 - 62. (For example, for 5ESS, "013750500011" would be the SPID for the number above, after adding "11" as the TID. For NTI, the SPID would be "54037505000011".)

The three major switch manufacturers all support a free-form SPID format. The SPID normally has two or three digits (e.g., area code), then the seven-digit telephone number, then one or two additional digits. A National line has the two-digit TID added at the end.

Enter the SPID using the keypad. Pressing **2nd FUNC**, **SCROLL** will backspace one character. Once the SPID has been entered, press the **SCROLL** key.

The Directory number menu will be displayed:



The Directory Number (sometimes called Primary Directory Number) is required for non-CACH translations. The DN is normally seven digits and is automatically populated from the SPID, but may be changed via this menu.

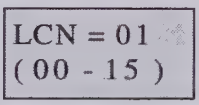
Once the Directory Number has been entered, press **SCROLL** to accept the DN. The "SCROLL To Quit" screen is displayed. Press **SELECT** to return to the SPID entry screen. Press **SCROLL** to exit the SPID menu. The Hook screen will be displayed.

1.3.3 BEAR CAP

Pressing **BEAR CAP** (key **2**) will display the following screen:

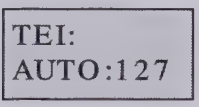
Pressing **SELECT** will scroll through available selections: "VOICE", "DATA 56k", "DATA 64k", "3.1 KHZ", OR "D-CH PKT". Press the **SCROLL** key to enter the desired setting.

If "D-CH PKT" is selected as the Call Type, the following menu will be displayed:



This menu selects the Logical Channel Number. The Logical Channel Number is used to designate the virtual channel to be used by a packet data call at the network interface. The default is 1.

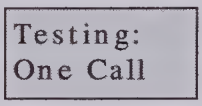
Enter the number using the keypad, followed by the **SCROLL** key to enter the number. The TEI menu will then be displayed:



Pressing **SELECT** will scroll through available selections: "AUTO" or "FIXED". If "FIXED" is selected, enter the TEI using the keypad. Press the **SCROLL** key to enter the desired setting.

The "SCROLL To Exit" screen is displayed. Press **SELECT** to return to the beginning of the bearer capability menu ("BEAR CAP" screen). Press **SCROLL** to exit the bearer capability menu. The Hook screen will be displayed.

If "VOICE", "DATA 56k", "DATA 64k", or "3.1KHZ" is selected as the Call Type, the following menu will be displayed:

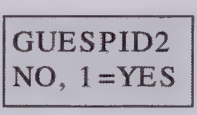


Pressing **SELECT** will scroll through available selections: "One Call" or "Dual Call". Press the **SCROLL** key to enter the desired setting.

NOTE: *The "Dual Call" feature is only available for Voice, Data, and 3.1kHz audio calls and does not apply to D-Packet calls.*

If "One Call" is selected, the "SCROLL To Exit" screen is displayed. Press **SELECT** to return to the beginning of the bearer capability menu ("BEAR CAP" screen). Press **SCROLL** to exit the bearer capability menu. The Hook screen will be displayed.

If "Dual Call" is selected, the following menu will be displayed:



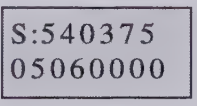
If you know the second SPID is for the circuit being tested, you can move to the SPID 2 entry screen by pressing the **SCROLL** key.

To have the test set "guess" the second SPID, press the **1** key. The following screen is displayed:

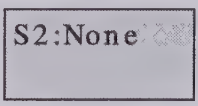
Enter the 10-digit phone number using the keypad, then press the **SCROLL** key.

NOTE: *If not connected to a line, pressing **SCROLL** will display a "NO LAYER 1" message.*

The test set momentarily displays "GUESSING SPID2", then begins to display possible SPIDs. If the test set is unable to "guess" the SPID, "SPID NOT FOUND" will be displayed. Once a valid SPID has been found, it is displayed as follows:



If SPID Guess is not selected, the following menu will be displayed:



This menu allows the SPID to be verified or changed.

Enter the SPID using the keypad. Pressing **2nd FUNC**, **SCROLL** will backspace one character. Once the SPID has been entered, press the **SCROLL** key.

Pressing **SELECT** will scroll through available selections: "PERFORM 2B TEST" or "QUIT 2B TEST". Press the **SCROLL** key to enter the desired selection.

Selecting "QUIT 2B TEST" displays the "SCROLL To Exit" screen. Pressing **SELECT** will return to the beginning of the bearer capability menu ("BEAR CAP" screen). Press **SCROLL** to exit the bearer capability menu. The Hook screen will be displayed.

If "PERFORM 2B TEST" was selected, testing will be initiated. The TPI 527 will attempt to draw dial tone on both B channels simultaneously. The result of this test will be displayed once the test is completed - "PASS" or an indication of the reason for failure, such as:

NO SYNC	PH1 REL
NO LINK 1	PH2 REL
NO LINK 2	Lost Sync
No Dtone1	Lost Ph1
No Dtone2	Lost Ph2

NOTE: *The "No Dtone2" message indicates that the test set was not able to draw dial tone on the second SPID. The second SPID could be incorrect, or the switch translations for the line may not support accessing both B channels simultaneously.*

If "PERFORM 2B TEST" fails, press the **SCROLL** key to display the "SCROLL To Exit" screen. Pressing **SELECT** will return to the beginning of the bearer capability menu ("BEAR CAP" screen). Press **SCROLL** to exit the bearer capability menu. The Hook screen will be displayed.

The "Cause" menu (**STATUS** key) can also be accessed to view the cause of the failure.

If "PERFORM 2B TEST" passes, press the **SCROLL** key to display the following menu:

```
CALLSELF
NO, 1=YES
```

This menu is used to initiate the Call Yourself, Loop, and BERT macro.

To bypass the Call Yourself, Loop, and BERT macro, press the **SCROLL** key. The "SCROLL To Exit" screen is displayed. Press **SCROLL** to exit the bearer capability menu. The Hook screen will be displayed.

To initiate the Call Yourself, Loop, and BERT macro, press the **1** key. The following screen is displayed:

```
Enter
Centrex
```

This screen is used to enter a Centrex prefix, if needed. Enter the Centrex prefix using the keypad.

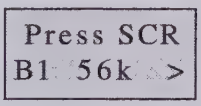
Press the **SCROLL** key to begin the Call Yourself, Loop, and BERT macro. The test set automatically goes off hook on the first number, dials the second number, answers the call, places a loopback on B1, and begins a BER test on B2. The BERT screen is displayed, with the number of Bit Errors (BE) on the second line. (For more information on BERT, refer to Section 1.3.4.)

To exit the Call Yourself, Loop, and BERT screen, press the **HOOK** key. The Hook screen is displayed as follows:

This screen indicates that a call is connected on B2 and BERT is running. Press the **HOOK** key again. The test set stops the BER test, removes the loopback from B1, and goes back on hook.

1.3.4 BERT

Pressing **BERT** (key **3**) will display the following screen:



The first line - "Press SCROLL for Results" - will roll across the screen. The second line, "B1 56k", indicates which B channel is currently selected for testing and the data rate for the test. The ">" on the bottom line indicates "more".

Press **SELECT** to view BERT selections: "B1 56k", "B1 64k", "B2 56k", or "B2 64k". Press the **SCROLL** key to enter the desired selection.

The following menu will then display:

The first line - "1=START BERT"" - will roll across the screen. The second line displays the number of bit errors. The ">" on the bottom line indicates "more".

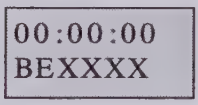
If **1** is selected, to start BERTing, the top line of the display will change to "1=CLEAR 2=STOP 3=Insert 6 ERR".

NOTE: *It is normal to get a burst of errors when a test is first started. Press **1** to clear the errors and reset the timer.*

Pressing **3** will insert 6 bit errors into the transmitted data.

NOTE: *When 6 bit errors are inserted into the transmitted data, they may or may not fall within the same errored second. The use of the "3=Insert 6 ERR" key might result in two errored seconds.*

Pressing **SELECT** will display the following menu:



This menu displays the test time and Bit Errors. Pressing **SELECT** will display Errored Seconds (ES) on the bottom line.

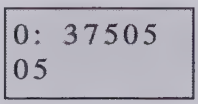
Press **2** to end the test, then press **SCROLL**. The "SCROLL To Exit" screen is displayed. Press **SELECT** to return to the beginning of the BERT menu ("Press SCROLL for results". Press **SCROLL** to exit the BERT menu. The Hook screen is displayed.

For more information, see Section 2.4 BER Testing.

1.3.5 STORE

This function allows frequently dialed numbers to be stored for future speed dial applications. Up to ten (10) numbers may be stored (in locations 0-9).

Pressing **STORE** (key **7**) will display the following screen:



The last number stored in position "0" will be displayed.

Enter the number to be stored using the keypad. The first key press will erase the previous number.

If a mistake is made, pressing **2nd Func.**, **Scroll** will erase the last digit.

Press the **SCROLL** key to move to the next stored number location (0-9).

Press **HOOK** to exit the Store menu. The Hook screen is displayed.

1.3.6 SPEED DIAL

Pressing **SPEED** (key **9**) will display the following screen:

```
spd dial
0-9:
```

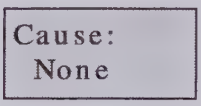
Using the keypad, select the stored number location under which the desired number is stored. The TPI 527 will go off hook and dial the stored number.

NOTE: *Access to a line should be made prior to using speed dial. Speed dial will not work unless a number has been stored.*

To exit the Speed Dial menu without dialing a stored number, press the **HOOK** key. The Hook screen is displayed.

1.3.7 STATUS

Pressing **STATUS** (key **0**) will display the following screen:



The second line will display the cause message, which, if in the VOICE or DATA mode, may be one of the following:

"None" = No cause message received.
1 "UNASSIGNED NUMBER"
2 "NO ROUTE TO NETWORK"
3 "NO ROUTE TO DESTINATION"
6 "CHANNEL UNACCEPTABLE"
7 "CALL AWARDED"
16 "NORMAL CLEARING"
17 "USER BUSY"
18 "NO USER RESPONSE"
19 "ALERTING NO ANSWER"
21 "CALL REJECTED"
22 "NUMBER CHANGED"
26 "NON SELECTED USER CLEARING"
27 "DESTINATION OUT OF ORDER"
28 "INVALID NUMBER FORMAT"
29 "REQESTED FACILITY REJECTED"
30 "RESPONSE TO STATUS ENQIRY"
31 "NORM UNSPECIFIED"
34 "NO CHAN AVAILABLE"
35 "QUEUED"
38 "NETWORK OUT ORDER"
41 "TEMPORARY FAILURE"
42 "NETWORK CONGESTION"
43 "ACCESS INFORMATION DISCARDED"

44 "CHANNEL NOT AVAILABLE"
47 "RESOURCE UNAVAILABLE"
49 "QUALITY OF SERVICE UNAVAILABLE"
50 "FACILITY NOT SUBSCRIBED"
52 "OUT CALLS BARRED"
54 "IN CALLS BARRED"
57 "BEARER CAPABILITY NOT AUTHORIZED"
58 "BEARER CAPABILITY NOT AVAILABLE"
63 "SERVICE NOT AVAILABLE"
65 "BEARER SERVIC NOT IMPLEMENTED"
66 "CHANNEL TYPE NOT IMPLEMENTED"
69 "REQESTED FACILITY NOT IMPLEMENTED"
70 "RESTRICTED DIGITAL ONLY"
79 "SERVICE NOT IMPLEMENTED"
81 "INVALID CALL REFERENCE VALUE"
82 "CHANNEL DOES NOT EXIST"
83 "NO CALL ID"
84 "CALL ID IN USE"
85 "NO CALL SUSPENDED"
86 "CALL CLEARED"
88 "INCOMPATIBLE DESTINATION"
91 "NETWORK DOES NOT EXIST"
95 "INVALID MESSAGE"
96 "INFORMATION ELEMENT MISSING"
97 "MESSAGE TYPE NON-EXSTENT"
98 "MESSAGE NOT COMPATIBLE"
99 "ELEMENT NON-EXISTENT"
100 "INVALID INFORMATION"
102 "RECOVERY ON TIMER EXPIRY"
111 "PROTOCOL ERROR"
127 "INTERWORKING"

However, in D-CH PKT mode, the cause messages come in 3 types: CLEAR, RESET, or RESTART indication packet. The message displayed will be one of the following:

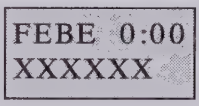
CLEAR indicator packet messages:
01 NUMBER BUSY
03 INVALID FACILITY REQUEST
05 NETWORK CONGESTION
09 OUT OF ORDER
11 ACCESS BARRED
13 NOT OBTAINABLE
17 REMOTE PROCEDURE ERROR
19 LOCAL PROCEDURE ERROR
21 RPOA OUT OF ORDER
25 REVERSE CHARGE NOT SUBSCRIBED
33 INCOMPATIBLE DESTINATION
41 FAST SELECT ACCEPTANCE NOT SUBSCRIBED

RESET indicator packet messages:
01 OUT OF ORDER
03 REMOTE PROCEDURE ERROR
05 LOCAL PROCEDURE ERROR
07 NETWORK CONGESTION
09 REMOTE DTE OPERATIONAL
15 NETWORK OPERATIONAL
17 INCOMPATIBLE DESTINATION
29 NETWORK OUT OF ORDER

RESTART indicator packet messages:
01 LOCAL PROCEDURE ERROR
03 NETWORK CONGESTION
07 NETWORK OPERATIONAL
127 REGISTRATION/CANCEL CONFIRMED

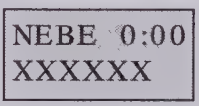
Check with your technical support organization for further explaination of each cause message.

If in U:NT1/TE mode, pressing **SCROLL** will move to the FEBE display:



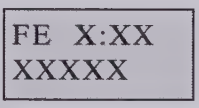
This menu reports the Far End Block Errors. Pressing **SELECT** resets the timer and error counter. A FEBE indicates a bit error was received at the far end.

Pressing **SCROLL** will move to the NEBE display:



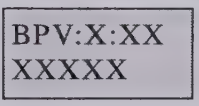
This menu reports the Near End Block Errors. Pressing **SELECT** resets the timer and error counter. A NEBE indicates a bit error has been received.

If in S/T:TE mode, pressing **SCROLL** will move to the FE display:



This menu reports the Frame Errors. Pressing **SELECT** resets the timer and error counter. Frame errors (FE) indicate an error in the framing pattern has been received.

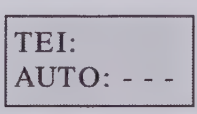
Pressing **SCROLL** will move to the BPV display:



This menu reports the Bipolar Violations. Pressing **SELECT** resets the timer and error counter.

BPV (Bipolar Violation) errors indicate two consecutive "1" bits of the same ploarity have been detected.

Pressing **SCROLL** will move to the TEI display:

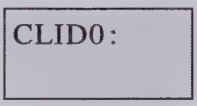


This menu reports the TEI selection (Auto or Fixed).

In U:NT1TE mode, Pressing **SCROLL** will move to the EOC display:

This menu reports the last message received over the EOC channel. Pressing **SELECT** will display the address of the received message.

Pressing **SCROLL** will move to the Caller ID display:



When an incoming call is received, this menu will display the calling party number, if the data received contains the calling party number. This menu can store up to ten CLID messages. To scroll through the CLID messages, press the **SELECT** key.

If in POTS mode, pressing **STATUS** (key **0**) will display the following screen:

When an incoming call is received, this menu will display the calling party number, if the data received contains the calling party number.

Press the **SCROLL** key to display the "SCROLL To Exit" screen. Pressing **SELECT** will return to the beginning of the status menu ("Cause:" screen). Press **SCROLL** to exit the status menu. The Hook screen will be displayed.

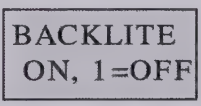
1.3.8 UTILITY

This key allows various utility functions to be performed.

Pressing **UTILITY** (key **#**) will display the following screen:

This display indicates the default setting of "5". Pressing **SELECT** will cycle through selections: "MIN", "1" through "9", and "MAX". Press the **SCROLL** key to enter the desired setting.

The following menu will be displayed:



This menu controls the LCD backlight. Pressing the **1** key will turn the backlight off or on.

Pressing **SCROLL** to move to the next menu:

HANDSET MODE

This menu selects the TPI 527 mode and the volume level. Pressing **SELECT** will scroll through available options: "HANDSET MODE" or "SPKR PHN, Volume=x". The volume is announced upon entering this menu.

In the ***Speaker Phone*** mode, the volume of the speaker is selectable via the keypad; in the ***Handset*** mode, the volume is pre-set at a fixed volume.

CAUTION! Do not place the ear piece (speaker) next to the ear unless the "Handset" mode has been selected. High audio volume could be present in the "Speaker Phone" mode.

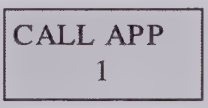
Press the **SCROLL** key to enter the desired setting. The following menu will result:

FIRMWARE VER=X.XX

This menu reports the firmware version number. Pressing **SELECT** will report the Hardware ver. Press the **SCROLL** key to move to the next screen.

With the POTS option installed, pressing **SCROLL** key will display the following menu:

This menu allows selection of the service. Pressing **SELECT** will scroll through available selections: "ISDN" or "POTS". This menu will not be displayed if the POTS option is not installed. Selecting POTS will change modes and display a message indicating the dialing method being used (pulse or tone). If ISDN is selected, the Call Appearance menu will result.



The default call appearance is 1.

For 5ESS Call Control, this menu allows the user to place outgoing calls on button numbers (1-254). Pressing **SELECT** will display "AUTO" on the bottom line. The "AUTO" selection automatically searches for the first call appearance on the line under test.

For DMS-F or NAT'L Call Control, this menu allows a selection for a call appearance. Pressing **SELECT** will display "NONE" on the bottom line. A Northern Functional Directory Number may also be needed (entered through the Setup menus).

Press the **SCROLL** key to enter the desired setting and the following menu will be displayed:

```
B1    OFF
1=LP  ON
```

This menu toggles loopbacks on either B channel. The loopbacks can only be toggled if the unit is connected to the switch. Pressing **SELECT** moves to the B2 loopback display. Press the **1** key to toggle the selected loopback on and off

Press the **SCROLL** key to move to the next menu. In U:NT1TE mode, the following menu will be displayed:

```
40k TONE
OFF, 1=ON
```

This menu is used to generate a 40 kHz tone, at approx. 0 dBm. The test tone is a sine wave signal that approximates the Nyquist frequency of the 2B1Q signal.

If the POTS2 option is installed and the unit is in U:NT1TE mode, pressing **SCROLL** will display the following menu:

```
40k MEAS
1=TEST
```

This menu can be used to measure a 40 kHz test tone sent from the far end. Press the **1** key to measure the 40 kHz tone. The results, displayed in dBm, indicate the loop loss on the line.

Press the **SCROLL** key and the following menu will be displayed:

```
AUTO PWR
DOWN OFF
```

The automatic power down feature enables the set to turn itself off to conserve battery life if there is no activity (sync or key press) for 5 minutes in ISDN mode, or 10 minutes in POTS mode. Press **SELECT** to toggle "ON" or "OFF".

NOTE: *The unit will auto power down whether or not the AC Adapter is used.*

If the POTS1 option is installed and the unit is in U:NT1TE mode, pressing **SCROLL** will display the following menu:

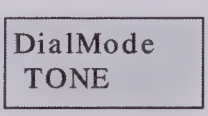
```
LOSS PAD
0 dB     >
```

Loss can be inserted on the U interface by pressing the **SELECT** key. Up to 12 dB of loss may be inserted, in intervals of 4 dB.

NOTE: *If high voltage (above 60 volts) is detected on the line, "HIGH VOLT" will be displayed and no loss pad selection can be made.*

Press the **SCROLL** key to enter the desired setting.

If in POTS mode, pressing **SCROLL** will display the following:



This menu allows selection of the dialing mode. Pressing **SELECT** will scroll through available selections: "TONE" or "PULSE". Press the **SCROLL** key to enter the desired setting.

The "SCROLL To Exit" screen is displayed. Pressing **SELECT** will return to the beginning of the **UTILITY** menu ("CONTRAST" screen). Press **SCROLL** to exit the **UTILITY** menu. The Hook screen will be displayed.

1.3.9 HOOK

Pressing the **HOOK** key will display the following menu:

The "V" in the upper right indicates voice testing. This menu may vary slightly depending on the Setup selections made.

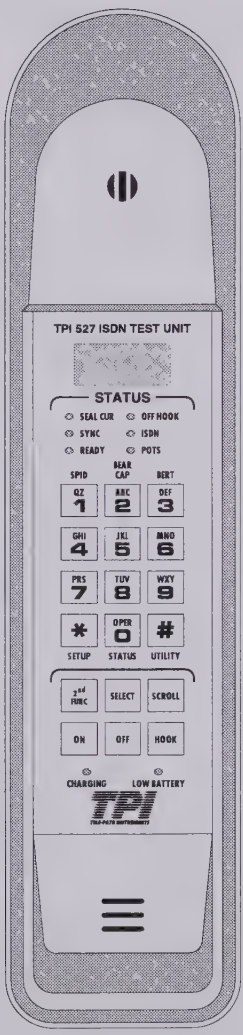
The ">" in the lower right indicates "more". The second line indicates the B channel to use for outgoing calls. In the above example "ANY" indicates outgoing calls will go out on the first available B channel. Pressing **SCROLL** will scroll through available selections: "B1", "B2", or "ANY".

The **HOOK** key is used to move between the On Hook and Off Hook modes when placing or receiving calls. The **OFF HOOK** LED will light green when in the Off Hook mode.

For more information on placing calls, see Section 2.4.

SECTION II

OPERATION


TPI 527 ISDN TEST UNIT
STATUS
SEAL CUR
OFF HOOK
SYNC
ISDN
READY
POTS
SPID
BEAR CAP
BERT
QZ 1
ABC 2
DEF 3
GHI 4
JKL 5
MNO 6
PRS 7
TUV 8
WXY 9
*
OPER 0
#
SETUP
STATUS
UTILITY
2nd FUNC
SELECT
SCROLL
ON
OFF
HOOK
CHARGING
LOW BATTERY
TPI

2.1 POWER UP

Press the power **ON** button. This will turn the ISDN Test Set on, and will start the Self Test routine. All LEDs except the **CHARGING** LED will light, then extinguish.

Upon successful completion of the Self Test, the following message will be momentarily displayed, stating that the self test has passed:

```
  PASS
X.XX
```

NOTE: *If the power up self test should fail, please contact TELE-PATH INSTRUMENTS - Customer Service - at (540) 375-0500.*

At the conclusion of the Self Test routine, the unit will display the last setup used:

```
U  VOICE
NAT'L
```

This menu indicates ISDN service, access at the U interface, voice bearer capability, and National call control.

This power up message prompts the user to consider the mode and setup for the current application, prior to taking any other action. If the setup shown is correct, press **SELECT** to accept. The Hook screen will be displayed. Should this last setup need to be changed, press **SCROLL**. This will walk through the entire setup procedure.

2.2 SETUP

Upon successful completion of the Self Test, the present setup of the unit will be displayed:

```
U VOICE
NAT'L
```

NOTE: *The setup menu may also be accessed by pressing the **SETUP** function key.*

This menu indicates ISDN service, access at the U interface, voice bearer capability, and National call control. Other menus follow to review/change these and other selections. If the setup shown is correct, press **SELECT** to accept. The Hook screen will be displayed. Should this last setup need to be changed, press **SCROLL**.

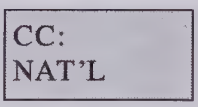
NOTE: *A "Service" selection - ISDN or POTS - is available under the* **UTILITY** *menu.*

The MODE menu will be displayed (if S/T option is installed, otherwise the call control menu):

```
MODE:
U:NT1TE
```

Pressing **SELECT** will scroll through available selections: "U:NT1TE" (U interface, NT1TE mode) or "S/T: TE" (S/T interface, TE mode). Press the **SCROLL** key to enter the desired setting.

The following menu will then appear:



Pressing **SELECT** will scroll through the selections: "NAT'L", "DMS-F", "5ESS-PP", or "5ESS-MP".

"NAT'L" (National ISDN) is the Bellcore standard call control. "DMS-F" is the custom call control used on Nortel switches. "5ESS-PP" and "5ESS-MP" are the custom call controls used on AT&T 5ESS switches.

Press the **SCROLL** key to enter the desired setting and the following menu will be displayed:

This menu selects the type of test (bearer capability). Pressing **SELECT** will scroll through available selections: "VOICE", "DATA 56k", "DATA 64k", "3.1KHZ", or "D-CH PKT". Press the **SCROLL** key to enter the desired setting.

If "5ESS-PP" was selected as the call control, the "No SPID in 5E-PP" message will be displayed. Press the **SCROLL** key to exit the Setup menu and move to the Hook screen.

If "NAT'L", "DMS-F", or "5ESS-MP" call control was selected, the following menu will be displayed:

```
GUESSPID
NO,1=YES
```

A Service Profile Identifier (SPID) is used by Terminal Equipment (TE) to request initialization from the switch on a multipoint circuit.

If you know what the SPIED is for the circuit being tested, you can move to the SPID entry screen by pressing the **SCROLL** key.

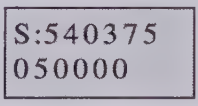
If you are not sure what the SPID is, the test set can often "guess" the SPID based on the 10-digit phone number (area code + directory number) assigned to the circuit. To have the test set "guess" the SPID, press the **1** key. The following screen is displayed:

```
Enter 10
Digit DN
```

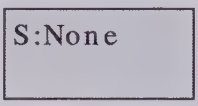
Enter the 10-digit phone number using the keypad, then press the **SCROLL** key.

NOTE: *If not connected to a line, pressing **SCROLL** will display a "NO LAYER 1" message.*

The test set momentarily displays "GUESSING SPID", then begins to display possible SPIDs. If the test set is unable to "guess" the SPID, "SPID NOT FOUND" will be displayed. Once a valid SPID has been found, is it displayed as follows:



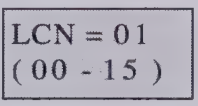
If SPID Guess is not selected, the following menu will be displayed:



This menu allows the SPID to be verified or changed (see section 1.3.2). Enter the SPID using the keypad. Pressing **2nd FUNC**, **SCROLL** will backspace one character.

Once the SPID has been "guessed" or entered with the keypad, press the **SCROLL** key to enter the SPID and exit the Setup menu. The Hook screen is displayed.

If "D-CH PKT" is selected as the TEST (bearer capability), the following menu will be displayed:



This menu selects the Logical Channel Number. The Logical Channel Number is used to designate the virtual channel to be used by a packet data call at the network interface. The default is 1.

Enter the number using the keypad, followed by the **SCROLL** key to enter the number. The TEI menu will then be displayed:

```
TEI:
AUTO:127
```

Pressing **SELECT** will scroll through available selections: "AUTO" or "FIXED". If "FIXED" is selected, enter the TEI using the keypad. Press the **SCROLL** key to enter the desired setting.

If "5ESS-PP" was selected as the call control, the "No SPID in 5E-PP" message will be displayed. Press the **SCROLL** key to exit the Setup menu and move to the Hook screen.

If "NAT'L", "DMS-F", or "5ESS-MP" call control was selected, the following menu will be displayed:

```
GUESSPID
NO,1=YES
```

If you know what the SPID is for the circuit being tested, you can move to the SPID entry screen by pressing the **SCROLL** key.

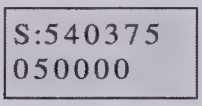
If you are not sure what the SPID is, press the **1** key. The following screen is displayed:

```
Enter 10
Digit DN
```

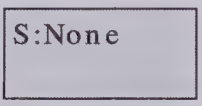
Enter the 10-digit phone number using the keypad, then press the **SCROLL** key.

NOTE: *If not connected to a line, pressing **SCROLL** will display a "NO LAYER 1" message.*

The test set momentarily displays "GUESSING SPID", then begins to display possible SPIDs. If the test set is unable to "guess" the SPID, "SPID NOT FOUND" will be displayed. Once a valid SPID has been found, is it displayed as follows:



If SPID Guess is not selected, the following menu will be displayed:



Enter the SPID using the keypad. Pressing **2nd FUNC**, **SCROLL** will backspace one character. Once the SPID has been "guessed" or entered with the keypad, press the **SCROLL** key to enter the D Packet SPID and exit the Setup menu. The Hook screen is displayed.

For information on the Hook screen, refer to Section 1.3.9.

2.3 PRE-QUALIFYING CABLE PAIRS

Pre-qualification of cable pairs is becoming more popular, so that cable construction people can have confidence that the copper plant will handle the service being planned for deployment, prior to the Central Office and Customer Premise equipment being connected.

The TPI 527 can be used at the Customer Premise along with a TPI 550B at the Central Office to pre-qualify a Basic Rate interface (BRI) cable pair.

The following procedures are recommended for pre- qualification:

1) Gain access to the cable pair under test using the **LINE** interface jack on both units.
2) Setup the units for the line under test.
   - The 527 should be in NT1TE mode.
   - The 550B should be in LT mode.
   - The **SYNC** LED on the 527 and the **Sync.** and **Active** LEDs on the 550B should light.

NOTE: *The Sealing Current (**SEAL CUR**) LED will not be lit, nor will the **READY** LEDs be lit on either unit. No calls can be placed, but the line can be qualified by testing B1 and B2, and checking for CRC and FEBE errors.*

3) B1 and B2 can be tested by performing a BER test in either a straightaway fashion, or by using the Central Office 550B to configure a loopback in the Customer Premise 527 and BERT to that loopback.

2.3.1 LOOPBACK FROM THE CENTRAL OFFICE

1) On the central office 550B, press the **Utility** key, then the **CONFIG** soft key.
2) Press **Scroll Menu**. The "2B1Q U INTERFACE" menu is displayed.
3) Press the **LTMODE** soft key to select Line Termination mode, then press **Scroll Menu**.

NOTE: *When sending an EOC channel command, e.g., B1 Loopback, the NT1 is always address 0 (default setting). A mid-span repeater, address 1, may also be controlled for loopbacks.*

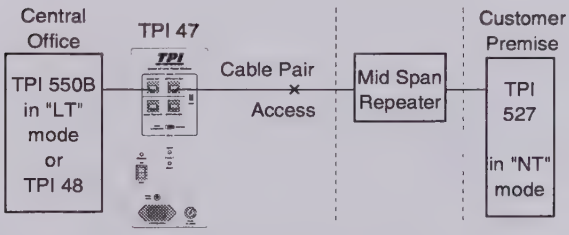
4) Press the **MESSAG** soft key until "2B+D LOOPBACK" is displayed on the third line. Press the **SEND** soft key.
5) Press the **2nd Func.** key then the **BERT** key.
6) Press the **Scroll Menu** key until the B channel selection screen is displayed.
7) Press the **BOTH** soft key then the **64K** soft key.
8) Press the **Scroll Menu** key until the **STRCLR** soft key appears.
9) Testing of both channel will begin when you press the **STRCLR** soft key.
10) Press the **STRCLR** soft key again to clear any errors. The Bit Errors (BE) and Errored Seconds (ES) for both channels should stop counting.

11) Run the test for the desired turn-up time and monitor results for acceptable error performance.
12) Testing will terminate when you press the **STOP** soft key.

2.3.2 REPEATERED LINE

A Basic Rate Interface (BRI) 2B1Q repeater is sometimes used in cases where a BRI line needs to be extended in order to reach a customer site.

For a line with a 2B1Q Repeater, the repeater must be powered in order for the whole loop to be tested. The TPI 47 Line Power Module may be used for this purpose. The diagram below shows the connections when using the TPI 47.



The switches on the TPI 47 should be set to **2B1Q** and **Normal**. Connect the TPI 47 **Model 546** jack to the **LINE** interface jack on the Central Office 550B. The **2B1Q Line Out** jack connects to the line under test.

Once the connections are made, the TPI 47 will power the repeater and testing between the TPI 550B and TPI 527 can proceed, as described in Section 2.3.1.

2.3.3 40 KHZ TEST TONE

The TPI 527 can generate a 40 kHz test tone for the 2B1Q signal at approx. 0 dB. A TPI 527 at the far end can measure the tone level and thus measure loop loss.

When performed during initial installation, this test will verify that the line loss is correct. The Actual Measured Loss (AML) is compared with the Estimated Measured Loss (EML).

The 40 kHz tone screens are available under the **UTILITY** menu. Press **SCROLL** to move to the "40k TONE" screen. This screen is used to generate the tone. Press **SCROLL** to view the "40k MEAS" screen. This screen measures the 40 kHz test tone received from the far end and displays the results in dBm. The results indicate the loop loss on the line.

2.4 PLACING CALLS

A voice, data 56k, data 64k, 3.1 kHz audio, or D channel packet call may be made by selecting **BEAR CAP**, while on hook. At power up, voice is the default setting.

After setup and bearer capability selections have been made, plug the line under test into the line interface jack on the lower end of the test set. The **SEALING CURRENT** LED will come on, then the **SYNC** LED will light green. After a few seconds, the **READY** LED will light green.

To place a voice call, go off hook and dial the desired number.

Placing a data call or a d channel packet call is accomplished in a similar manner.

NOTE: *If the optional S/T interface capability is installed, selecting the S/T mode in* ***SETUP*** *will allow placement of calls by the TPI 527 over the S/T interface as described.*

Selecting the POTS service (if installed) through the **UTILITY** *menus will allow placement of a voice call on a standard voice line.*

2.4.1 HOW TO MAKE A VOICE CALL

For most circuits, a SPID (Service Profile Identifier) will have to be entered via the ***SETUP*** *or* ***SPID*** *key (or the call will be denied).*

The call control must be selected.

ISDN switches may take up to two minutes to initialize when access is gained and/or when a mode change takes place. Wait for the ***READY*** *LED to light green before going off hook.*

1) In voice or 3.1 kHz audio mode, go off hook by pressing the HOOK key (will hear dial tone).

2) Enter the number using the keypad.

3) Conversation may now take place.

4) To end a voice call, go on hook by pressing the **HOOK** key.

NOTE: *If the optional POTS capability is installed, selecting POTS in the* **UTILITY** *menu will allow placement of a voice call by going off hook and dialing.*

OUBLESHOOTING TIPS

1) For most circuits, the SPID must be entered prior to going off hook (use **SPID** key).

2) If dial tone has not been gained, or the call can not be completed, the TPI 527 will display a diagnostic cause message. (See Quick Reference "Diagnostic Cause Messages".)

3) If the setup needs to be checked, press the **SETUP** key, to walk step-by-step through menus that will configure the TPI 527 for the circuit being accessed.

NOTE: *The call control must be selected.*

*Wait for the **READY** LED to light before going off hook.*

2.3.2 HOW TO MAKE A DATA CALL

The **BEAR CAP** key will allow the user to choose between placing a voice, circuit-switched data, or D channel packet call.

For circuit-switched data calls, the **BEAR CAP** key gives the user access to two types of data calls:

1) 56000 b/s Unrestricted

2) 64000 b/s Unrestricted

Once the speed has been selected, a circuit-switched data call may be placed by using the **HOOK** key, just like a voice call.

*For most circuits, a SPID will have to be entered via the **SPID** key (or the call will be denied).*

The call control must be selected.

*ISDN switches may take up to two minutes to initialize when access is gained and/or when a mode change takes place. Wait for the **READY** LED to light before going off hook.*

1) Press the **BEAR CAP** function key and press **SELECT** to enter the desired data speed. Press **SCROLL**, then select "One Call", and **SCROLL** two times to exit.
2) A circuit-switched data call may now be placed, just like a voice call.
   A - Go off hook, by pressing the **HOOK** key (may hear dial tone).
   B - Enter the number, using keypad.
3) To end a data call, go on hook by pressing the **HOOK** key.

TROUBLESHOOTING TIPS

1) It is best to verify that a voice call can be made successfully, prior to attempting a data call.

2) For most circuits, the SPID must be entered prior to going off hook (use **SPID** key).

3) A dial tone may or may not be heard depending upon the Central Office switch setup. DTMF tones during dialing will be heard.

4) If the call can not be completed, the TPI 527 will display a diagnostic cause message. (See Quick Reference "Diagnostic Cause Messages".)

5) If the setup needs to be checked, press the **SETUP** key, to walk step-by-step through menus that will configure the TPI 527 for the circuit being accessed.

2.3.3 HOW TO MAKE A D CHANNEL PACKET CALL

The **BEAR CAP** key allows the user to choose between placing a voice call, circuit-switched data call,or D channel packet call.

Once the Logical Channel Number and TEI have been selected, a D channel packet call may be placed by using the **HOOK** key, similar to a voice call.

*For most circuits, a SPID will have to be entered via the **SPID** key (or the call will be denied).*

The call control must be selected.

*ISDN switches may take up to two minutes to initialize when access is gained and/or when a mode change takes place. Wait for the **READY** LED to light before going off hook.*

1) Press the **BEAR CAP** function key and press **SELECT** TO scroll to "D-CH PKT". **SCROLL** to accept the selection.
2) Enter the LCN and TEI. Press **SCROLL** to accept these entries and exit.
3) Press the **HOOK** key (LCD will indicate "Ready Dial:").
4) Enter the number of the loopback device, using the keypad.
5) Press the # key to send the call (LCD will display "CONNECT:"

6) Press the **1** key to send the following message over the D channel: "01:The red fox jumped over the lazy dog." Each time **1** is pressed, the message will be sent with the number incrementing with each press. However, only the first two characters will be displayed, i.e., "T01". The "T" at the beginning of the message indicates a Transmitted message. Press **2** to clear the message.

7) The TPI 527 will display any information coming to it on the LCD screen. An "R" at the beginning of the message indicates a Received message. Depending on the loopback device used, the *received* message may be "R01" (if a TPI 560 is used) or "RXX" (the first two characters of the message).

8) To end a D channel packet data call, go on hook by pressing the **HOOK** key.

TROUBLESHOOTING TIPS

1) It is best to verify that a voice call can be made successfully, prior to attempting a D channel packet call.

2) For most circuits, the SPID must be entered prior to going off hook (use **SPID** key).

3) TEI assignment must have been made before dial tone can be heard (Check for **READY** LED or use the **STATUS** menus to verify a TEI has been assigned.)

4) If the call is not successful, a cause message will be displayed on the LCD. For more information, the Status menu can be accessed to view a diagnostic cause message. (See Quick Reference "Diagnostic Cause Messages" for "D-CH PKT" mode.)

5) If the setup needs to be checked, press the **SETUP** key, to walk step-by-step through menus that will configure the TPI 527 for the circuit being accessed.

6) If the LCD doesn't indicate "Ready" when the **HOOK** key is pressed, the X.25 link hasn't been made.

7) If the LCD doesn't indicate "CONNECT" when the # key is pressed to send the call, the call was not successful.

2.4.4 DUAL CALLS

The dual call feature of the TPI 527 enables dial tone to be drawn on both B channels, a call to be placed from one number to the other, and a BER test to run using both B channels. This allows testing of the full 128K bandwidth. These tests can be accomplished by selecting "Testing: Dual Call" in the **BEAR CAP** menu.

Once a second SPID has been entered (if needed), press **SCROLL** to move to the "PERFORM 2B TEST" screen. Press **SCROLL** to start the test.

The unit will then attempt to draw dial tone on the two B channels simultaneously. If successful, "PASS" will be reported. If the test fails, a brief indication of the reason for failure will be displayed, such as:

NO SYNC	PH1 REL
NO LINK 1	PH2 REL
NO LINK 2	Lost Sync
No Dtone1	Lost Ph1
No Dtone2	Lost Ph2

NOTE: *The "No Dtone2" message indicates that the test set was not able to draw dial tone on the second SPID. The second SPID could be incorrect, or the switch translations for the line may not support accessing both B channels simultaneously.*

If "PERFORM 2B TEST" fails, press the **SCROLL** key to display the "SCROLL To Exit" screen. Pressing **SELECT** will return to the beginning of the bearer capability menu ("BEAR CAP" screen). Press **SCROLL** to exit the bearer capability menu. The Hook screen will be displayed.

The "Cause" menu (**STATUS** key) can also be accessed to view the cause of the failure.

If "PERFORM 2B TEST" passes, press the **SCROLL** key to display the following menu:

```
CALLSELF
NO,1 =YES
```

This menu is used to initiate the Call Yourself, Loop, and BERT macro.

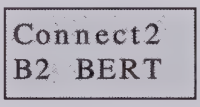
To initiate the Call Yourself, Loop, and BERT macro, press the **1** key. The following screen is displayed:

```
Enter
Centrex
```

This screen is used to enter a Centrex prefix, if needed. Enter the Centrex prefix using the keypad.

Press the **SCROLL** key to begin the Call Yourself, Loop, and BERT macro. The test set automatically goes off hook on the first number, dials the second number, answers the call, places a loopback on B1, and begins a BER test on B2. The BERT screen is displayed, with the number of Bit Errors (BE) on the second line. (For more information on BERT, refer to section 1.3.4.)

To exit the Call Yourself, Loop, and BERT macro, press the **HOOK** key. The Hook screen is displayed as follows:



This screen indicates that a call is connected on B2 and BERT is running. Press the **HOOK** key again. The test set stops the BER test, removes the loopback from B1, and goes back on hook.

Dual Call testing is now complete.

2.5 BER TESTING

2.5.1 Setup = Use **SETUP** key
[ISDN service]
[U:NT1TE mode]
[NAT'L, DMS-F, or 5ESS call control]
[DATA bear. cap. (test)]
Enter SPID

2.5.2 Connection = Use 8-pin jack

2.5.3 Place A Call = Use **HOOK** key

= Use keypad to dial

2.5.4 BER Testing = Use **2nd FUNC**, **BERT** keys

Pressing **2nd FUNC**, **BERT** will display the following screen:

```
Press SCR
B1  56k   >
```

The first line - "Press SCROLL for Results" - will roll across the screen. The second line, "B1 56k", indicates which B channel is currently selected for testing and the data rate for the test. The ">" on the bottom line indicates "more".

Press **SELECT** to view BERT selections: "B1 56k", "B1 64k", "B2 56k", or "B2 64k". Press the **SCROLL** key to enter the desired selection.

- The B channel should be the B channel shown when the call was connected.
- Speed should be 64k for Clear Channel testing and 56k for Non-Clear Channel.

The following menu will then display:

The first line - "1=START BERT"" - will roll across the screen. The ">" on the bottom line indicates "more".

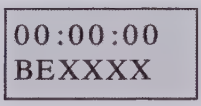
If **1** is selected, to start BERTing, the top line of the display will change to "1=CLEAR 2=STOP 3=Insert 6 ERR".

NOTE: *It is normal to get a burst of errors when a test is first started. Press **1** to clear the errors and reset the timer.*

Pressing **3** will insert 6 bit errors into the transmitted data.

NOTE: *When 6 bit errors are inserted into the transmitted data, they may or may not fall within the same errored second. The use of the "3=Insert 6 ERR" key might result in two errored seconds.*

Pressing **SELECT** will display the following menu:



This menu displays the test time and Bit Errors. Pressing **SELECT** will display Errored Seconds (ES) on the bottom line.

Press **2** to end the test. The "SCROLL To Exit" screen is displayed. Press **SELECT** to return to the beginning of the BERT menu ("Press SCROLL for Results). Press **SCROLL** to exit the BERT menu. The Hook screen is displayed.

2.6 BASIC RATE INTERFACE VERFICIATION (BRIV)

2.6.1 GENERAL INFORMATION

BRIV is a BELLCORE specification feature that is becoming supported on the switches with National call control. BRIV is implemented as a test line (example 9999) that the technician calls to receive information on where the line is physically located in the CO. A BRIV call can be placed from the U or S/T interface after the unit has been assigned a TEI and has initialized the SPID. The voice or data call is answered by the BRIV. The BRIV messages are sent over the D channel and displayed on the TPI 527.

2.6.2 PLACING A BRIV CALL

1) Place a voice or data call to the designated BRIV line. Once the call is connected, the BRIV information is displayed on the TPI 527.

2) The BRIV line will leave the call connected and display the information for a designated period of time. This information should follow the BELLCORE Specification.

3) Go on hook to terminate the call.

2.7 TESTING AT THE U INTERFACE

2.7.1 Setup = Use **SETUP** key
[ISDN service]
[U:NT1TE mode]
[NAT'L, DMS-F, or 5ESS call control]
[VOICE, DATA, 3.1KHZ, or D-CH PKT bear cap (Test)]
Enter SPID

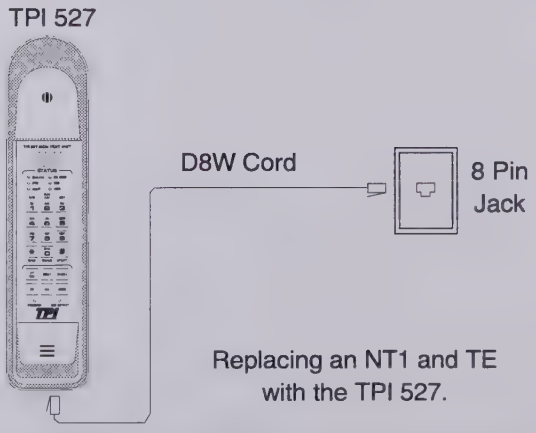
2.7.2 Connection = Use 8-pin jack
[Connect test cord to line under test]

2.7.3 Place A Call = Use **HOOK** key
[Go off hook]

= Use keypad to dial

2.7.4 Errored Second Testing = Use **2nd FUNC**, **STATUS** keys

2.7.5 BER Testing = Use **2nd FUNC**, **BERT** keys



Replacing an NT1 and TE with the TPI 527.

2.8 TESTING AT THE S/T INTERFACE

2.8.1 Setup = Use **SETUP** key
[ISDN service]
[ST:TE mode]
[NAT'L, DMS-F, or 5ESS call control]
[VOICE, DATA, 3.1KHZ, or D-CH PKT bear cap (Test)]
Enter SPID

2.8.2 Connection = Use 8-pin jack
[Connect test cord to line under test]

2.8.3 Place A Call = Use **HOOK** key
[Go off hook]

= Use keypad to dial

2.8.4 Errored Second Testing = Use **2nd FUNC**, **STATUS** keys

2.8.5 BER Testing = Use **2nd FUNC**, **BERT** keys

2.9 TESTING AT THE POTS INTERFACE

2.9.1 Setup = Use **UTILITY** key [POTS service]

2.9.2 Mode = On Hook screen, use **SELECT** key [TERM.]

2.9.2 Connection = Use 8-Pin Jack [Connect a test cord to the line under test]

2.9.3 Place A Call = Use **HOOK** key [Go off hook]

= Use keypad

If Caller ID information on an incoming call is available, the ID number will be displayed.

NOTE: *Attempting a call on an active digital line (i.e., ISDN or DDS) will enable the Sense-IT™ feature, which senses data on the line. A "DATA ON LINE" warning message will be displayed on the LCD when the **HOOK** key is pressed.*

Unintrusive monitoring of the POTS interface is available from the Hook screen by pressing the **SELECT** key to change from "TERM" to "MONITOR" mode.

2.10.6 ONE PERSON ISDN TURN UP

2.10.1 EQUIPMENT

TPI 527 ISDN Test Unit
TPI 560B ISDN Dial Up Test Unit

2.10.2 GENERAL INFORMATION

The TPI 527 ISDN Test Unit is used to conduct testing of ISDN circuits at the Customer Premise, the input and output of the ISDN repeater housing, or at the main Distribution Frame. The TPI 527 will function as a Network Termination/ Terminal Equipment [NT1/TE]. It may be connected to either the Digital Subscriber Loop [DSL], or the S/T interface (if optioned). Once connected, the TPI 527 will allow the technician to place voice, data, or D channel packet calls, set up loopbacks, and conduct BER testing.

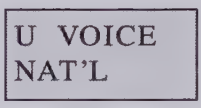
The TPI 560B ISDN Dial Up Test Unit is used for automated assistance in the turning up of new ISDN circuits. The TPI 560B is normally installed permanently in the Central Office [CO] in a 19-inch or 23-inch rack. The CO will assign a number to allow a test technician to dial the TPI 560B. Once accessed, the TPI 560B will allow the technician to test the line that he is calling from by ringing the technician back, setting up loopbacks, and/or allowing BER testing.

2.10.3 EQUIPMENT SETUP

TPI 527

Connection to the ISDN line is made at the 8-pin jack on the bottom end of the TPI 527.

1) When the TPI 527 is first used on an ISDN circuit, the technician will have to set the unit up in accordance with the line parameters. For example, upon power up of the TPI 527, a screen such as the typical screen shown below will be displayed, which reflects the last setup:



2) If the setup needs to be changed, press **SCROLL** and follow the menu prompts.

TPI 560B

Connections to the ISDN switch are made at the TPI 560B rear panel, via the terminal block.

1) Connect the Tip lead of the line that is dedicated to the TPI 560B to the terminal marked **T**.
2) Connect the Ring lead of the line that is dedicated to the TPI 560B to the terminal marked **R**.
3) The line connected to the TPI 560B must be set up as if it were an actual ISDN line being supplied to a customer with translation for Automatic Number Identification [ANI].

4) When the TPI 560B is first installed, the technician will have to setup the unit to match the line parameters. For example, upon power up, a screen such as the screen below will be displayed, which reflects the last setup:

```
ISDN NT1TE 2B1Q NAT'L
1=ACCEPT    2=CHANGE
```

5) If the setup needs to be changed, select **2** and follow the menu prompts.

2.10.4 VOICE TURN UP PROCEDURE

Once the TPI 560B has been setup properly, the STATUS LEDs for **Sync**, **Active** and **Ready** should illuminate.

Once the TPI 527 has been setup properly, the STATUS LEDs for **SYNC** and **READY** should illuminate.

1) Go off hook - dial tone should be heard [if not, check SPID]. (The TPI 527 defaults to voice service.
2) Enter the number for the TPI 560B.
3) The TPI 560B will automatically answer and announce "Hello, TPI 560B Automated Test Line", followed by the service (voice or data), calling party number, and "Hang up for call back", to the TPI 527.
4) Following this message, the technician should hang up, by going on hook with the 527.

5) The TPI 560B then goes off hook and places a call back to the TPI 527.
6) Go off hook. The TPI 560B will announce "Hello, TPI 560B Automated Test Line. Entering Loopback", then enter a loopback state on the assigned B channel, allowing BER testing with the TPI 527 to verify the quality of the line.
7) The TPI 560B will release automatically if the caller hasn't hung up after 15 minutes.
8) The TPI 560B is now ready for the next call.

2.10.5 CIRCUIT SWITCHED DATA TURN UP PROCEDURE

1) Same as voice, except the TPI 527 must be configured for **DATA** (56k or 64k) via the BEAR CAP menu, prior to placing the call.

2.10.6 D CHANNEL PACKET DATA TURN UP PROCEDURE

1) Configure the TPI 527 for voice and verify dial tone by going off hook. Hang up by going on hook.
2) Use the **BEAR CAP** menu to change the bearer capability to "D-CH PKT". **SCROLL** to verify the LCN and TEI, then **SCROLL** to exit the bearer capability menu.
3) Using the TPI 527, go off hook and the display should say "Ready Dial:".
4) Using the TPI 527, enter the number for the TPI 560B, followed by **#**, to send the number.

5) The TPI 560B will automatically answer and send a connect message to the TPI 527.

6) Using the TPI 527, hang up by going on hook.

7) The TPI 560B will go off hook and dial the TPI 527.

8) The TPI 527 automatically answers the incoming D channel packet call.

9) The TPI 560B will then send a connect message to the TPI 527. Next, the TPI 560B will enter into a packet echo mode.

10) The TPI 527 can now be used to send the Fox message by selecting **1** on the keypad. Each time **1** is pressed, the message will be sent with the number incrementing with each press. However, only the first two characters will be displayed, i.e., "T01". The "T" at the beginning of the message indicates a Transmitted message.

11) When this message reaches the TPI 560B, it will be sent back to the TPI 527. The TPI 527 will display any information coming to it on the LCD screen. An "R" at the beginning indicates a Received message, i.e., "R01".and the first two characters will be displayed on the screen.

12) The TPI 527 can clear the screen [select "**2**"], and resend the message [select "**1**"]. If this message is received error free, the quality of the connection is verified.

13) The TPI 560B will release the call automatically if the caller hasn't hung up after 15 minutes.

APPENDIX A

MAINTENANCE

CABLES AND ACCESSORIES

The TPI 527 ISDN Test Unit comes equipped with the following cables and accessories:

PART #	DESCRIPTION
TPI 527-1 (TPI 851555)	AC Adapter/Battery Charger [12VDC, 500mA]
TPI 527-2 (TPI 834005)	8-Pin Mod to Mod Cable
TPI 527-3L (TPI 836175)	8-Pin Mod to 2-Alligator Clips Cable

The TPI 527 ISDN Test Unit has several ***optional*** features and accessories which may be ordered:

PART #	DESCRIPTION
TPI 527-7 (TPI 837185)	Soft Pack Carry Case
TPI 527-8 (TPI 834045)	8-Pin Mod to Heat Coil Protector Plug
TPI 527-PIM (TPI 836180)	Programming Interface Module
TPI 527-S/T (TPI 836192)	S/T Interface
TPI 527-POTS1 (TPI 836191)	POTS Interface (includes ISDN U loss pad capability and pulse dial)
or	
TPI 527-POTS2	POTS Interface (includes pulse dial, Caller ID, Sense-IT™ , and 40kHz measure)
TPI 527-F/W	Firmware Enhancement Agreement
TPI 527-UPD	Firmware Update

MAINTENANCE

The only replaceable parts on the ISDN Test Unit are the external cords. The LED indicators and keypad are soldered into the unit and are not field replaceable.

If the TPI 527 operation should become suspect, the unit may be checked for proper operation by performing a SELF TEST, This is done by turning the power off then on again, which will initiate a Power-Up Self Test and the unit will report the last setup. If this procedure does not operate successfully, contact the factory Customer Service department at 540-375-0500.

CALIBRATION

Calibration is not required for the TPI 527, due to the digital nature of its design, and due to the synchronous nature of the derived timing from ISDN networks. If proper operation of the ISDN Test Unit is in question, the Power-Up Self Test mentioned above may be performed.

BATTERY RECHARGE

Recharge time is 12 to 14 hours (overnight). Due to battery shelf life, leaving the unit on a shelf for months at a time can drain the battery, and over an extended length of time, may damage the battery. For proper battery maintenance, TPI recommends that the battery be recharged at least once every two (2) months.

SPECIFICATIONS

PHYSICAL

"U" Interface (Standard)
2B1Q
LINE INTERFACES (Optional)
S/T
POTS
POWER
Internal 9.6 Super NiCAD rechargeable battery
Battery Charger/AC Adapter
Battery Recharge = 12 to 14 hours
Recharge at least once every 2 mo.
WEIGHT
1.7 pounds
DIMENSIONS
2 3/4" deep, 2 3/4" wide, 12" long
OPERATING TEMPERATURE RANGE
0°C to +50°C

OPERATIONAL

MODES
NT1 (NT1 Replacement)
per ANSI T1.601 (1988)

MEASUREMENTS/INDICATORS

TEST RESULTS
2B1Q Line Code
FEBE Errors
NEBE Errors
Line Polarity
BER Testing

LED INDICATORS

STATUS

SEAL CUR	-	Indicates that Sealing Current is present on the DSL
	-	GREEN indicates Sealing Current with normal polarity
	-	RED indicates Reversed Polarity
SYNC	-	Indicates DSL is Framed (Framing Pattern)
READY	-	Indicates DSL is Activated (Act bit is set to network)
OFF HOOK	-	Indicates that the TPI 527 is in a call state
ISDN	-	Will light green when in the ISDN mode
POTS	-	Will light green when in the POTS mode
CHARGING	-	Will light Green to indicate that the battery is charging when the AC Adapter has been plugged into an AC 110V outlet.
LOW BATTERY-		Indicates a Battery Low condition, with a maximum of ten minutes of operating time remaining before complete shutdown

APPENDIX B

QUICK REFERENCE

QUICK REFERENCE

HOW TO MAKE A VOICE CALL

For most circuits, a SPID (Service Profile Identifier) will have to be entered via the **SETUP** *or* **SPID** *key (or the call will be denied).*

The call control must be selected.

ISDN switches may take up to two minutes to initialize when access is gained and/or when a mode change takes place. Wait for the **READY** *LED to light green before going off hook.*

1. In the voice or 3.1 kHz audio mode, go off hook by pressing the **HOOK** key (will hear dial tone).
2. Enter the number using the keypad.
3. Conversation may now take place.
4. To end a voice call, go on hook by pressing the ***HOOK*** key.

TROUBLESHOOTING TIPS

1. For most circuits, the SPID must be entered prior to going off hook (use **SPID** key).
2. If dial tone has not been gained or the call can not be completed, the TPI 527 will display a diagnostic cause message. (See Quick Reference "Diagnostic Cause Messages")
3. If the setup needs to be checked, press the **Setup** key to walk step-by-step through menus that will configure the TPI 527 for the circuit being accessed.

QUICK REFERENCE

HOW TO MAKE A DATA CALL

For most circuits, a SPID (Service Profile Identifier) will have to be entered via the **SETUP** *or* **SPID** *key (or the call will be denied).*

The call control must be selected.

ISDN switches may take up to two minutes to initialize when access is gained and/or when a mode change takes place. Wait for the **READY** *LED to light green before going off hook.*

❶ Press the **BEAR CAP** function key.
❷ Press **SELECT** to change to "DATA 56k" or "DATA 64k" and **SCROLL**, then select "One Call" and **SCROLL** two times to exit.
❸ A data call may now be placed.
A - Go off hook by pressing the **HOOK** key (may hear dial tone).
B - Enter the number, using the keypad.
❹ To end a data call, go on hook by pressing the ***HOOK*** key.

TROUBLESHOOTING TIPS

❶ It is best to verify that a voice call can be made successfully, prior to attempting a data call.
❷ If dial tone has not been gained, or the call can not be completed, the TPI 527 will display a diagnostic cause message. (See Quick Reference "Diagnostic Cause Messages".)
❸ If the setup needs to be checked, press **SETUP** to walk through menus that will configure the TPI 527 for the circuit being accessed.

QUICK REFERENCE

HOW TO MAKE A D-CH PKT CALL

For most circuits, a SPID (Service Profile Identifier) will have to be entered via the **SETUP** *or* **SPID** *key (or the call will be denied).*

The call control must be selected.

ISDN switches may take up to two minutes to initialize when access is gained and/or when a mode change takes place. Wait for the **READY** *LED to light green before going off hook.*

❶ Press the **BEAR CAP** function key.
❷ Press **SELECT** to move to "D-CH PKT" and press **SCROLL** to accept the selection.
❸ Enter the LCN and TEI. Press **SCROLL** to accept these entries and exit.
❹ Press the **HOOK** key (LCD will indicate "Ready:Dial").
❺ Enter the number, using the keypad.
❻ Press the # key to send the call (LCD will display "CONNECT:")
❼ Press the **1** key to send the following message over the D channel: "01:The red fox jumped over the lazy dog." Each time **1** is pressed, the message will be sent with the number incrementing with each press. However, only the first two characters will be displayed. The "T" at the beginning of the message indicates a Transmitted message Press **2** to clear the message.
❽ The TPI 527 will display any information coming to it on the LCD screen. The "R" at the beginning of the message indicates a Received message.
❾ To end a D channel packet call, go on hook by pressing the ***HOOK*** key.

QUICK REFERENCE

TROUBLESHOOTING TIPS

❶ It is best to verify that a voice call can be made successfully, prior to attempting a D packet call.

❷ For most circuits, the SPID must be entered prior to going off hook (use **SPID** key).

❸ TEI assignment must have been made before dial tone can be heard (Check for **READY** LED or use the **STATUS** menus to verify a TEI has been assigned.

❹ If the call can not be completed, the TPI 527 will display a diagnostic cause message. (See Quick Reference "Diagnostic Cause Messages".)

❺ If the setup needs to be checked, press the **SETUP** key to walk step-by-step through menus that will configure the TPI 527 for the circuit being accessed.

❻ If the LCD doesn't indicate "Ready" when the **HOOK** key is pressed, the X.25 link hasn't been made.

❼ If the LCD doesn't indicate "CONNECT:" when the # key is pressed to send the call, the call was not successful.

QUICK REFERENCE

DIAGNOSTIC CAUSE MESSAGES

If dial tone has not been gained or the call can not be completed, the TPI 527 a diagnostic cause message, which, in "VOICE" or "DATA" may be one of the following:

"NONE" = No cause message received.

1 "UNASSIGNED NUMBER"
2 "NO ROUTE TO NETWORK"
3 "NO ROUTE TO DESTINATION"
6 "CHANNEL UNACCEPTABLE"
7 "CALL AWARDED"
16 "NORMAL CLEARING"
17 "USER BUSY"
18 "NO USER RESPONSE"
19 "ALERTING NO ANSWER"
21 "CALL REJECTED"
22 "NUMBER CHANGED"
26 "NON SELECTED USER CLEARING"
27 "DESTINATION OUT OF ORDER"
28 "INVALID NUMBER FORMAT"
29 "REQESTED FACILITY REJECTED"
30 "RESPONSE TO STATUS ENQIRY"
31 "NORM UNSPECIFIED"
34 "NO CHAN AVAILABLE"
35 "QUEUED"
38 "NETWORK OUT ORDER"
41 "TEMPORARY FAILURE"
42 "NETWORK CONGESTION"
43 "ACCESS INFORMATION DISCARDED"
44 "CHANNEL NOT AVAILABLE"

QUICK REFERENCE

DIAGNOSTIC CAUSE MESSAGES (cont'd)

47 "RESOURCE UNAVAILABLE"
49 "QUALITY OF SERVICE UNAVAILABLE"
50 "FACILITY NOT SUBSCRIBED"
52 "OUT CALLS BARRED"
54 "IN CALLS BARRED"
57 "BEAR CAPABILITY NOT AUTHORIZED"
58 "BEAR CAPABILITY NOT AVAILABLE"
63 "SERVICE NOT AVAILABLE"
65 "BEARER SERVIC NOT IMPLEMENTED"
66 "CHANNEL TYPE NOT IMPLEMENTED"
69 "REQEST FACILITY NOT IMPLEMENTD"
70 "RESTRICTED DIGITAL ONLY"
79 "SERVICE NOT IMPLEMENTED"
81 "INVALID CALL REFERENCE VALUE"
82 "CHANNEL DOES NOT EXIST"
83 "NO CALL ID"
84 "CALL ID IN USE"
85 "NO CALL SUSPENDED"
86 "CALL CLEARED"
88 "INCOMPATIBLE DESTINATION"
91 "NETWORK DOES NOT EXIST"
95 "INVALID MESSAGE"
96 "INFORMATION ELEMENT MISSING"
97 "MESSAGE TYPE NON-EXSTENT"
98 "MESSAGE NOT COMPATIBLE"
99 "ELEMENT NON-EXISTENT"
100 "INVALID INFORMATION"
102 "RECOVERY ON TIMER EXPIRY"
111 "PROTOCOL ERROR"
127 "INTERWORKING"

QUICK REFERENCE

DIAGNOSTIC CAUSE MESSAGES (cont'd)

However, in "D-CH PKT" mode, the cause messages come in 3 types: CLEAR, RESET, or RESTART indication packet. The message displayed will be one of the following:

CLEAR indicator packet messages:
- 01 NUMBER BUSY
- 03 INVALID FACILITY REQUEST
- 05 NETWORK CONGESTION
- 09 OUT OF ORDER
- 11 ACCESS BARRED
- 13 NOT OBTAINABLE
- 17 REMOTE PROCEDURE ERROR
- 19 LOCAL PROCEDURE ERROR
- 21 RPOA OUT OF ORDER
- 25 REVERSE CHARGE NOT SUBSCRIBED
- 33 INCOMPATIBLE DESTINATION
- 41 FAST SELECT ACCEPTANCE NOT SUBSCRIBED

RESET indicator packet messages:
- 01 OUT OF ORDER
- 03 REMOTE PROCEDURE ERROR
- 05 LOCAL PROCEDURE ERROR
- 07 NETWORK CONGESTION
- 09 REMOTE DTE OPERATIONAL
- 15 NETWORK OPERATIONAL
- 17 INCOMPATIBLE DESTINATION
- 29 NETWORK OUT OF ORDER

RESTART indicator packet messages:
- 01 LOCAL PROCEDURE ERROR
- 03 NETWORK CONGESTION
- 07 NETWORK OPERATIONAL
- 127 REGISTRATION/CANCEL CONFIRM

QUICK REFERENCE

HOW TO MAKE A DUAL B-CHANNEL CALL

For most circuits, a SPID (Service Profile Identifier) will have to be entered via the **SETUP** *or* **SPID** *key (or the call will be denied).*

The call control must be selected.

ISDN switches may take up to two minutes to initialize when access is gained and/or when a mode change takes place. Wait for the **READY** *LED to light green before going off hook.*

1. Press the **BEAR CAP** function key.
2. Press **SELECT** to move to "VOICE", "DATA 56k", or "DATA 64k" or **DATA 64**.
3. Press **SCROLL** to view the "Testing" menu. Press **SELECT** to move to "Dual Call".
4. Enter the second SPID, if needed, then press **SCROLL**.
5. From the next menu, press **SELECT** to view the "CALLSELF" screen.
6. Press **1** to initiate the call yourself, loop, and BERT macro. Enter a Centrex prefix, if needed.
7. Press the **SCROLL** key to start the test. The test set automatically goes off hook on the first number, dials the second number, answers the call, places a loopback on B1, and begins a BER test on B2. The BERT screen is displayed, with the number of Bit Errors (BE) on the second line.

APPENDIX C

GLOSSARY

AMI *Alternate Mark Inversion* - A switch vendor's proprietary line code (i.e., AT&T AMI, NTI AMI).

ANI *Automatic Number Identification* - Ability of the network to notify the called party of the calling party's number.

B channel *Bearer Service Channel* - Operates at 64 kb/s and carries user voice and data.

BERT *Bit Error Rate Testing* - A test in which a series of bits arranges in a pseudo-random pattern are transmitted and then compared bit-by-bit for errors called "bit errors" or "logic errors."

BPV *Bipolar Violation*

B8ZS *Binary 8 Zero Substitution* - Code that replaces a string of 8 zeros by inserting a one bit in place of a zero in the T-Carrier transmission to allow for clear channel 64 kb/s channels.

BRI *Basic Rate Interface* - One of the access methods to an ISDN circuit. Comprising of either 1B+D or 2B+D channels.

BRITL *Basic Rate Interface Dial Up Test Line* - A feature of AT&T switches.

Call Control - Switch protocol/message structure.

Cause Message - Diagnostic messages describing the "cause" of a problem.

CCIS *Common Channel Interoffice Signaling* - North American version of Signaling System 6.

CCS *Common Channel Signaling* - Out of band network signaling whereby several voice trunks share a common signaling channel (i.e., SS6 and SS7).

CLASS *Custom Local Area Signaling Services* - A set of services that is offered by telcos that have implemented SS7.

CODEC *Coder/Decoder* - Device used to convert analog signals to digital bit streams and vice versa.

CPE *Customer Premise Equipment* - Devices or equipment that the customer provides to interface with the telephone company.

CRC *Cyclic Redundancy Check* - A mathematical algorithm used to detect bit errors in data transmission.

DCE *Data Circuit-terminating Equipment* - Term defined by other frame relay and x.25 committees that applies to switching equipment and is distinguished from the devices that attach to the network (DTE). See also DTE.

D channel - The out of band signaling channel that carries ISDN network signals. It can also be used to carry packet-mode user data. The D-Channel operates at 16 kb/s in the BRI and 64 kb/s in the PRI.

DSL *Digital Subscriber Line* - A technology that provides full-duplex service on a single twisted metallic pair at a rate sufficient to support ISDN Basic Access and additional framing, timing recovery, and operations functions. The physical termination of the DSL at the network end is the LT; the physical termination at the user end is the NT.

DTE *Data Terminal Equipment* - In the RS-232-C standard specifications, the RS-232-C is connected between the SCE and a DTE. The main difference between a DCE and a DTE is that pins two and three are reversed.

EBS *Electronic Business Set* - Also known as P-Phone, this is a proprietary service provided by Northern Telecom DMS or SL switches.

EOC *Embedded Operations Channel* - Optional data links within the signal for operations and maintenance use by carriers that do not terminate or channelize the 64-kb/s facility data link.

HDLC *High-level Data Link Control* - A generic link-level communications protocol developed by the International organization for Standardization (ISO). HDLC manages synchronous, code-transparent, serial information transfer over a link connections.

IEC *Inter-Exchange Carrier* - In the U.S. is a long distance telephone company (also abbreviated IC and IXC).

ISDN *Integrated Services Digital Network* - An ISDN provides a wide range of voice and nonvoice services within the same network using a limited set of connection types and multipurpose user-network interface arrangements. A variety of implementation configurations is supported, including circuit-switched, packet-switched, and nonswitched connections and their concatenations. New services are arranged to be compatible with 64 kb/s switched digital connections. Service features, maintenance capabilities, and network management functions are provided through intelligence built into the network and compatible intelligence in the user terminals.

ISPBX *Integrated Services Private Branch Exchange* - A term describing an ISDN-compatible PBX.

IVDT *Integrated Voice/Data Terminal* - An ISDN terminal that allows both voice and data communications.

LAPD *Link Access Protocol on the D channel* - The ISDN data link layer protocol specified for the D channel.

LT *Line Termination* - The equipment that terminates the access line at the network end.

M channel - A 4 kb/s maintenance channel for NT1-TE communication over the 2-wire BRI circuit

Multipoint - Configuration that supports multiple terminal equipment devices.

NI-1 *National ISDN-1* - A standard call control and feature set for BRI.

NT *Network Termination* - In this standard, the equipment that terminates the DSL on the customer side of the interface. The NT function may be in an NT1, and NT2, or a TE.

NT1 *Network Termination type 1* - The ISDN device responsible for the termination of the ISDN transmission facility at the customer premises.

NT2 *Network Termination type 2* - An ISDN device responsible for on premises communications distribution, such as a PBX, LAN, or Host Computer.

Octet - An eight (8) bit quantity; used in lieu of the term "Byte".

PS1 *Power Source 1* - The Sealing Current power, derives its power locally (commercial power and/or batteries). The source may be an integral part of the NT.

PS2 *Power Source 2* - The Stand Alone Power Pair, also derives its power locally (commercial power and/or batteries). The source may be located or associated with the NT or it may be located separately; e.g., in a remote wiring closet.

PS3 *Power Source 3* - An optional power source that may be used in some cases.

PLP *Packet Layer Protocol* - The X.25 Level 3 protocol.

Point to Point - Point to point connection.

POTS *Plain Old Telephone Service*

PRI *Primary Rate Interface* - One of the access methods to an ISDN circuit. Comprising of 23 B channels and one D channel (23B+D).

SAPI *Service Access Point Identifier* - A subfield in the LAPD address field which indicates the type of Level 3 service being obtained.

SPID *Service Profile Identifier* - A number used by Terminal Equipment to request identification from the switch on a multipoint circuit.

SPM *Service Profile Management* - A service of Nortel switches that provides the user's terminal with the service parameters contained in its network profile (from NIS S208-5, Issue 10).

SS6 *Signaling System No. 6* - CCITT version of CCIS, one of the first common channel signaling networks.

SS7 *Signaling System No. 7* - The high speed, digital common channel signaling network required for ISDN applications.

Smart Jack - Network termination device for DS1 circuits.

S/T Interface - The standard 4-wire (2 Rx, 2 Tx) ISDN Interface used by ISDN terminals and is the physical interface on the terminal side of a NT1.

STP *Signal Transfer Point* - A SS7 switching point.

TE *Terminal Equipment* - Any ISDN compatible device that may be placed on the network, such as a telephone, IVDT, PBX, TV, PC, etc.

TE1 *Terminal Equipment type 1* - ISDN compatible terminal equipment.

TE2 *Terminal Equipment type 2* - Non-ISDN compatible terminal equipment.

TEI *Terminal Endpoint Identifier* - A subfield in the LAPD address field that identifies a given TE device on the ISDN interface.

TID *Terminal Identifier* - A TID value is unique within a given USID. If two terminals on an interface subscriber to the same service profile, then the two terminals will be assigned the same service USID. However, two different TIDs are required to uniquely identify each of the two terminals.

Transport Layer *Layer 4 of OSI Reference Model* - Primarily responsible for error free communication between two hosts across the subnetwork.

2B1Q *Two Binary One Quaternary* - A signaling method used across the 2-wire BRI (U reference point). 2B1Q is a four level line code associating 2 bits to each line signal.

U Interface - The physical 2-wire echo canceling interface on the network side of a NT1.

USID *User Service Identifier* - A USID uniquely identifies a service profile on an access interface.

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